TENTATIVE

All information in this technical data sheet is tentative and subject to change without notice.

Preliminary

12.1” SVGA

TECHNICAL SPECIFICATION

AC121SA01

MITSUBISHI ELECTRIC Corp.

Date: Aug.31,’10

CONTENTS

1. APPLICATION

This specification applies to color TFT-LCD module, AC121SA01.

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(1) Standard Usage

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(2) Special Usage

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2. OVERVIEW

AC121SA01 is 12.1" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, LED driver and backlight unit.

By applying 6 bit or 8 bit digital data, 800 × 600, 262k-color or 16.7M-color images are displayed on the 12.1" diagonal screen. Input power voltage is 3.3V for LCD driving.
The type of data and control signals are digital and transmitted via LVDS interface per Typ. 40 MHz clock cycle.

General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	246.0(H) × 184.5(V) (12.1-inch diagonal)
Number of Dots	800 × 3 (H) × 600 (V)
Pixel Pitch (mm)	0.3075 (H) × 0.3075 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white
Number of Color	262k(6 bit/color), 16.7M(8 bit/color)
Luminance (cd/m^2)	(450)
Viewing Angle (CR ≥ 10)	(–80~80°)(H), (–60~80°)(V)
Surface Treatment	Anti-glare and hard-coating 3H
Electrical Interface	LVDS (6 bit/8 bit)
Viewing Direction	Higher Contrast ratio: 6 o'clock Less gray scale reversal: 12 o'clock
Module Size (mm)	260.5 (W) × 203.0 (H) × 9.5 (D)
Module Mass (g)	(600)
Backlight Unit	LED, edge-light, Unreplaceable

Characteristic value without any note is typical value.

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX	UNIT
Power Supply Voltage for LCD	VCC	0	4.0	V
Logic Input Voltage	VI	–0.3	VCC+0.3	V
Backlight Voltage	VL	–0.3	(14.0)	V
Backlight ON-OFF	BLEN	–0.3	VL	V
Light Dimming Control (PWM) Input Voltage	V_{PDIM}	–0.3	5.8	V
Operation Temperature (Panel) Note 1,2)	$T_{op(Panel)}$	–30	80	°C
Operation Temperature (Ambient) Note 2)	$T_{op(Ambient)}$	–30	80	°C
Storage Temperature Note 2)	T_{stg}	–30	80	°C

[Note]

1) Measured at the center of active area and at the center of panel back surface

2) Top,Tstg ≤ 40°C : 90%RH max. without condensation

Top,Tstg > 40°C : Absolute humidity shall be less than the value of 90%RH at 40°C without condensation.

4. ELECTRICAL CHARACTERISTICS

(1) TFT-LCD

Ambient temperature: Ta = 25°C

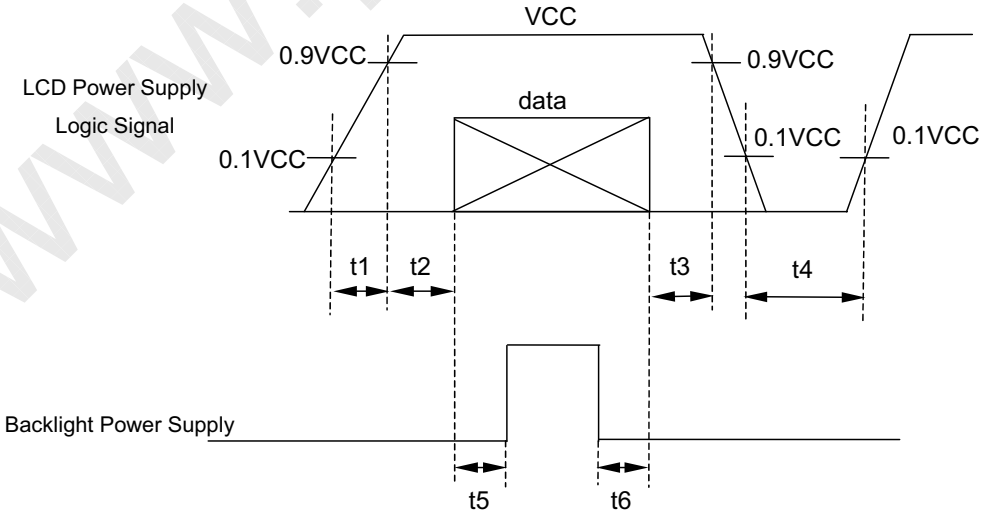
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Voltages for LCD		VCC	3.0	3.3	3.6	V	*1)
Power Supply Currents for LCD		ICC	--	(280)	TBD	mA	*2)
Permissive Input Ripple Voltage		VRP	--	--	100	mVp-p	VCC = +3.3V
Logic Input Voltage	High	VIH	0.7×VCC	--	VCC	V	MODE, SC
	Low	VIL	0	--	0.3×VCC	V	MODE, SC

*1) Power and signals sequence:

t1 ≤ 10 ms 200 ms ≤ t4

0 < t2 ≤ 50 ms 200 ms ≤ t5

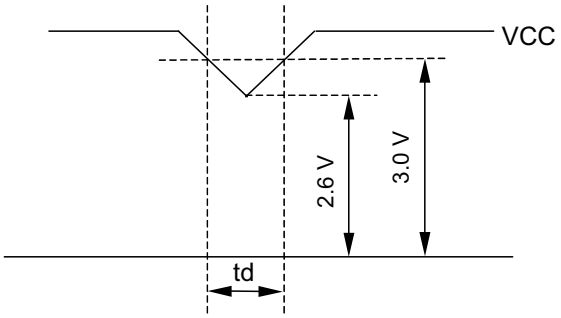
0 < t3 ≤ 50 ms 0 ≤ t6



data: RGB DATA, DCLK, DENA, MODE, SC

VCC-dip conditions:

1) When 2.6 V ≤ VCC < 3.0 V, td ≤ 10 ms
2) When VCC < 2.6 V
   VCC-dip conditions should also follow the power and signals sequence.



*2) VCC = +3.3 V, f_H=37.9 kHz, f_V=60 Hz, f_{CLK}=40 MHz
Display image at typical power supply current value is 256-gray-bar pattern (8 bit), 600 line mode.

*3) Fuse

Parameter	Fuse Type Name	Supplier	Remark
VCC	TBD	TBD	*)

*) The power supply capacity should be designed to be more than the fusing current.

(2)Backlight Ta=25°C

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Input Voltage		VL	10.8	12.0	13.2	V	*1)
Power Supply Input Current		IL	TBD	(600)	TBD	mA	*2, *4)
Power Supply Input Current		PL	--	(7.2)	TBD	W	Dimming=100%, VL=12V
Backlight ON-OFF	High	BLEN	(2.5)	--	(VL)	V	ON
	Low		(0)	--	(0.4)	V	OFF
Light Dimming Control (PWM) Input Voltage	High	V_{PDIM}	(1.8)	--	(5.0)	V	ON
	Low		0	--	(0.8)	V	OFF
PWM frequency		f_{PDIM}	(100)	(400)	(500)	Hz	*3)
Pulse width of PDIM		t_{PDIM}	(20)	--	DC	us	*3)
LED Life Time		LT	--	(60,000)	--	h	*5)

*1) Power and signals sequence:

TBD

*2) Includes rush current. PL≠VL×IL

*3) Lower frequency causes the flicker or the image breaking of motion picture.
Depending on the PDIM signal integrity (jitter etc.), the flicker may be visible. Please evaluate in advance.
The dimming ratio (D) can be calculated by following equation:
$D = f_{PDIM} \times t_{PDIM}$. Therefore, the minimum dimming ratio is $f_{PDIM} \times t_{PDIM(min)}$

*4) Fuse

Parameter	Fuse Type Name	Supplier	Remark
VL	TBD	TBD	*)

*) The power supply capacity should be designed to be more than the fusing current.

*5) LED life time is defined as the time when the brightness becomes 50% of the initial value.

5. INTERFACE PIN CONNECTION

(1) CN 1(Interface Signal)

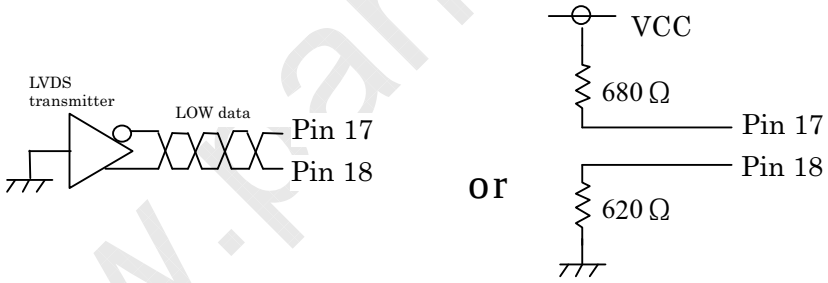
Used connector: 20186-020E-11F(I-PEX)

Corresponding connector: 20197-020U-F (I-PEX), FI-S20S (JAE), FI-SE20ME (JAE)

Pin No.	Symbol	Function (ISP 6 bit compatibility mode)		Function (ISP 8 bit compatibility mode)
		6 bit input	8 bit input	
1	VCC	+3.3 V Power supply		←
2	VCC	+3.3 V Power supply		←
3	GND	GND		←
4	GND	GND		←
5	Link 0–	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0
6	Link 0+	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0
7	GND	GND		←
8	Link 1–	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1
9	Link 1+	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1
10	GND	GND		←
11	Link 2–	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA
12	Link 2+	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA
13	GND	GND		←
14	CLKIN–	Clock –		←
15	CLKIN+	Clock +		←
16	GND	GND		←
17	Link3–	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7
18	Link3+	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7
19	MODE	Low=ISP 6 bit compatibility mode		High=ISP 8 bit compatibility mode
20	SC	Scan direction control (Low=Normal, High=Reverse)		←

*1) Metal frame is connected to signal GND.

*2) Recommended wiring of Pin 17,18 (6 bit input)



(2) CN 2(Backlight)

Backlight-side connector: FI-S6P-HFE (JAE)

Corresponding connector: FI-S6S (JAE)

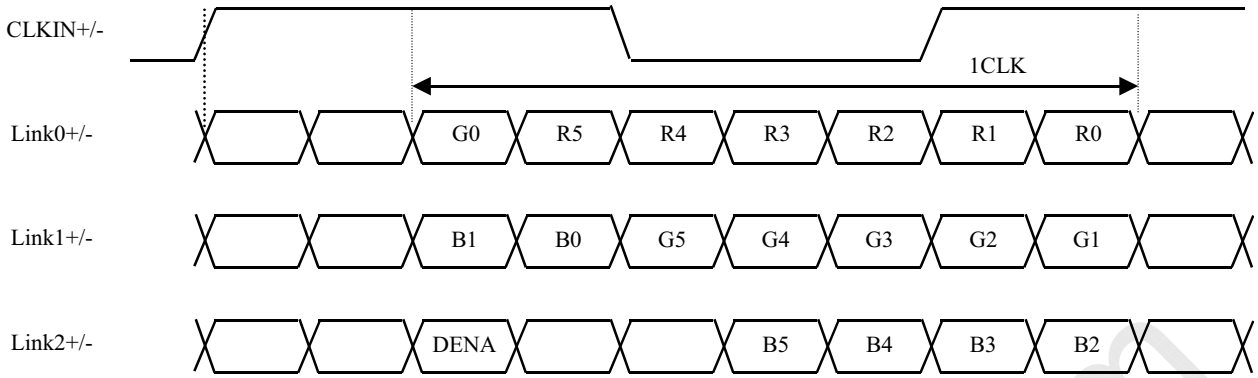
Pin No.	Symbol	Function
1	VL	Power Supply Input Voltage
2	VL	Power Supply Input Voltage
3	GNDL	GND
4	GNDL	GND
5	BLEN	Backlight ON-OFF (High: ON, Low: OFF)
6	V_{PDIM}	Light Dimming Control (PWM) Input Voltage (High active)

*1) GNDL is connected GND (of CN1) and the LCD frame internally.

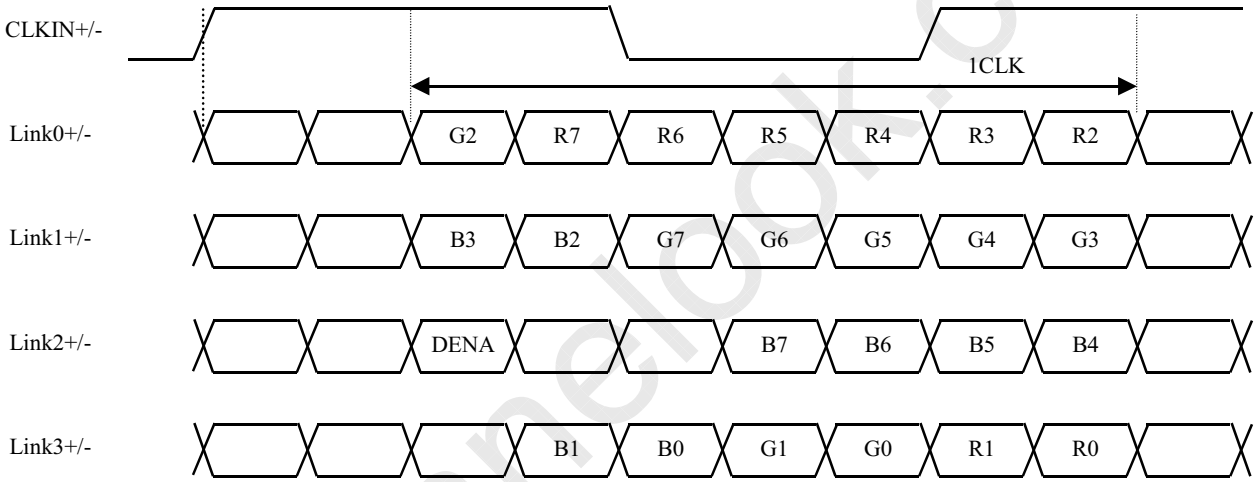
*2) BLEN is NOT designed for dimming.

(3) ISP data mapping

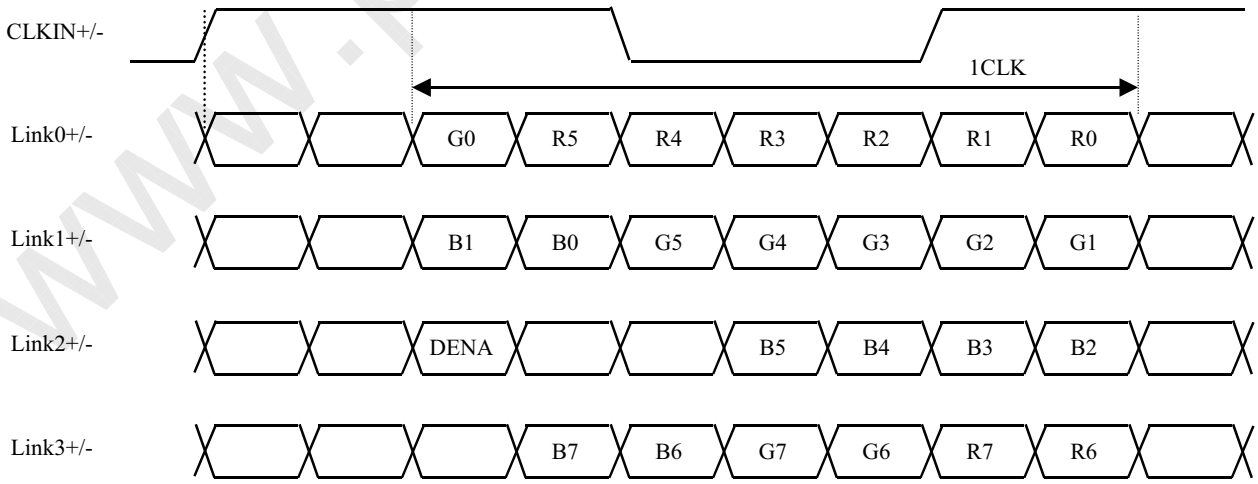
a. ISP 6 bit compatibility mode(6 bit input)



b. ISP 6 bit compatibility mode(8 bit input)



c. ISP 8 bit compatibility mode



6. INTERFACE TIMING

LVDS transmitter input signal

(1) Timing Specifications

ITEM			SYMBOL	MIN	TYP	MAX	UNIT
DCLK	Frequency		f_{CLK}	35	40	42	MHz
	Period		t_{CLK}	23.8	25	28.6	ns
DENA	Horizontal	Active Time	t_{HA}	800	800	800	t_{CLK}
		Blanking Time	t_{HB}	30	256	--	t_{CLK}
		Frequency	f_H	35.2	37.9	39.2	kHz
		Period	t_H	25.5	26.4	28.4	μs
	Vertical	Active Time	t_{VA}	600	600	600	t_H
		Blanking Time	t_{VB}	3	28	--	t_H
		Frequency	f_V	55	60	64.2	Hz
		Period	t_V	15.6	16.7	18.2	ms

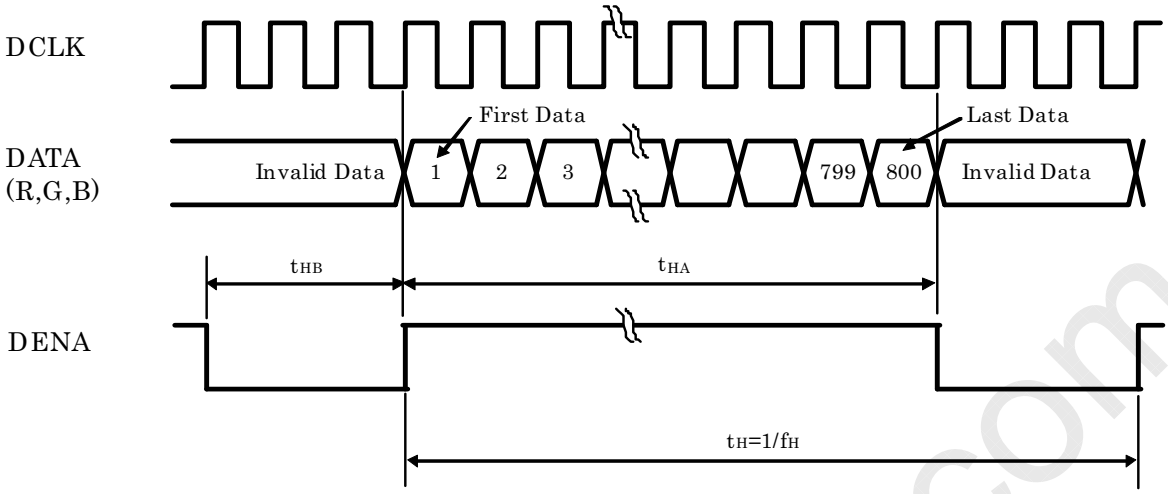
[Note]

1) DENA (Data Enable) should always be positive polarity as shown in the timing specification.
2) DCLK should appear during all invalid period.
3) LVDS timing follows the timing specifications of LVDS receiver IC: THC63LVDF84B(Thine).
4) In case of blanking time fluctuation, please satisfy following condition.

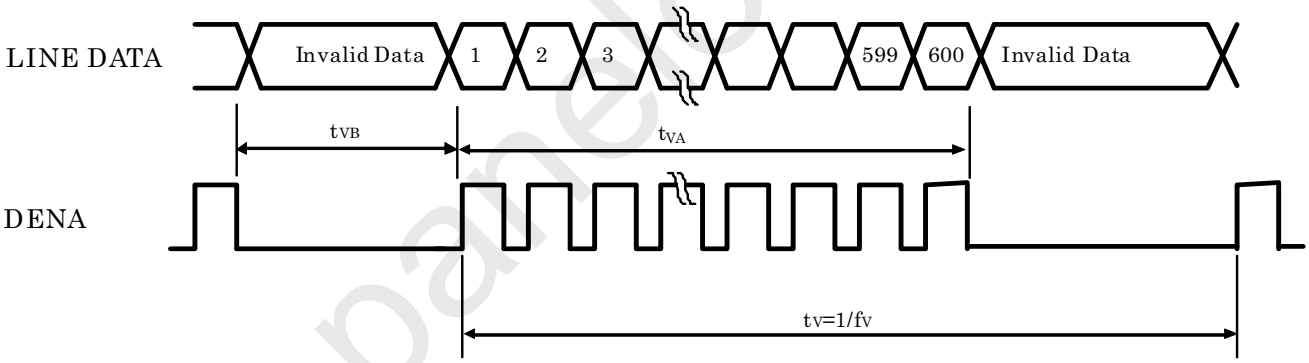
$t_{VBn} > t_{VBn-1} - 3(t_H)$

(2) Timing Chart

a. Horizontal Timing Chart



b. Vertical Timing Chart



(3) Color Data Assignment

a. 6 bit input

COLOR		INPUT DATA																	
		R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB					LSB	MSB					LSB	MSB					LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

[Note]

1) Definition of gray scale

Color (n) --- n indicates gray scale level.

Higher n means brighter level.

2) Data

1:High, 0: Low

b. 8 bit input

COLOR		INPUT DATA																							
		R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB							LSB	MSB							LSB	MSB							LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

[Note]

1) Definition of gray scale

Color (n) --- n indicates gray scale level.

Higher n means brighter level.

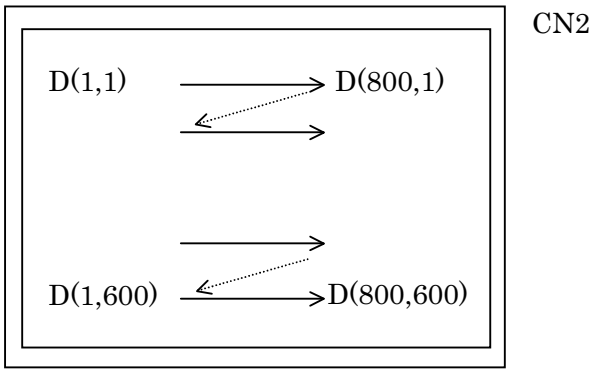
2) Data

1:High, 0: Low

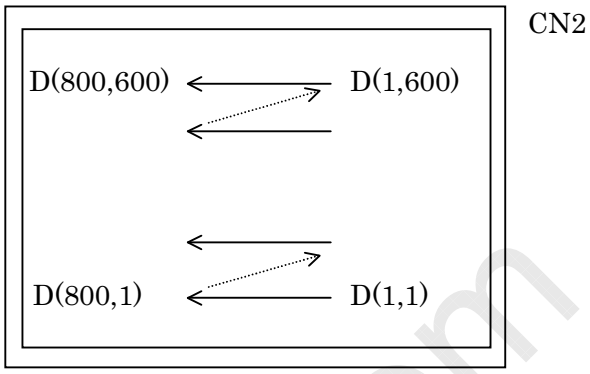
(4) Display Position and Scan Direction

D(X,Y) shows the data number of input signal.

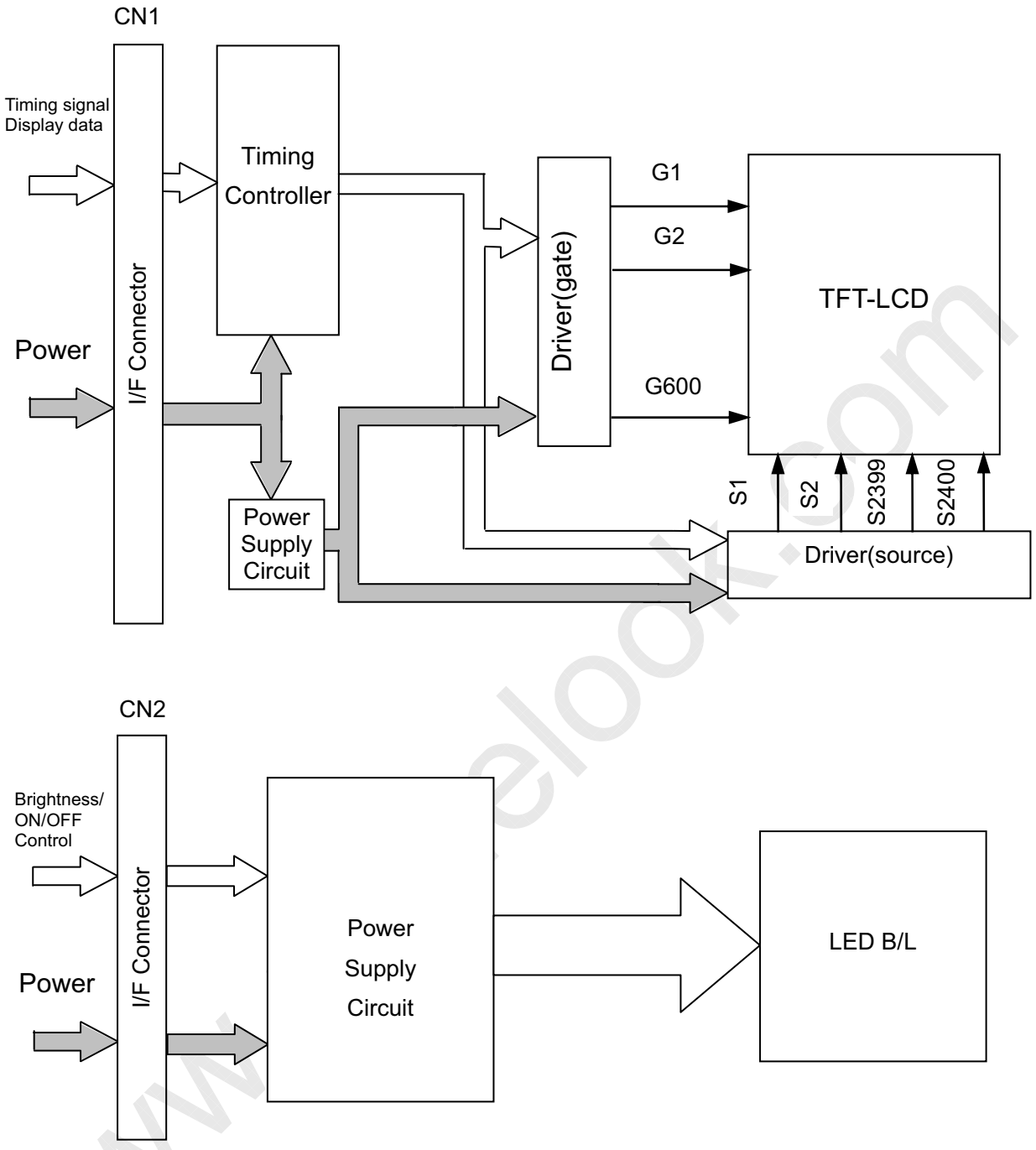
SC: Low



SC: High

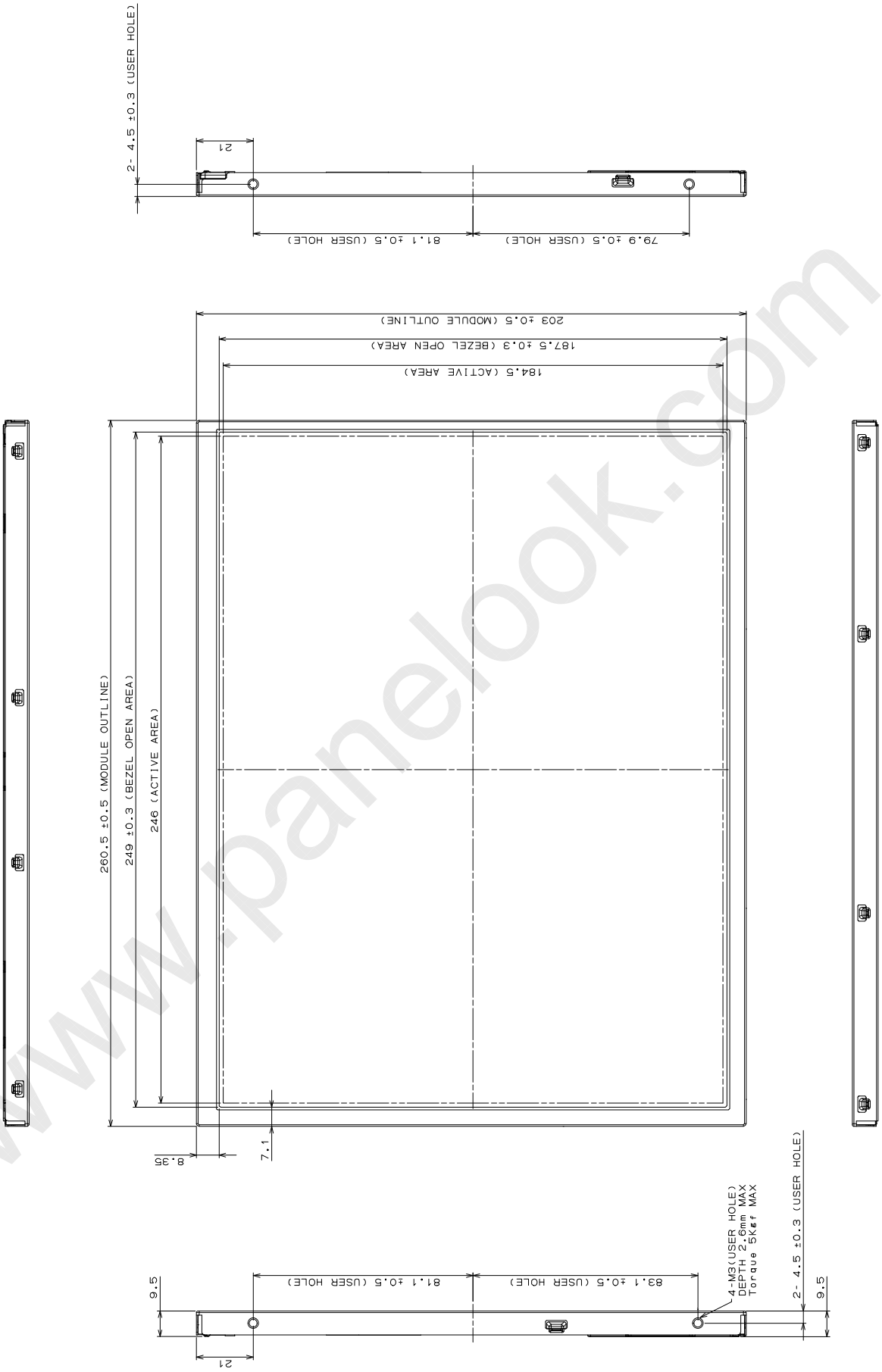


7. BLOCK DIAGRAM



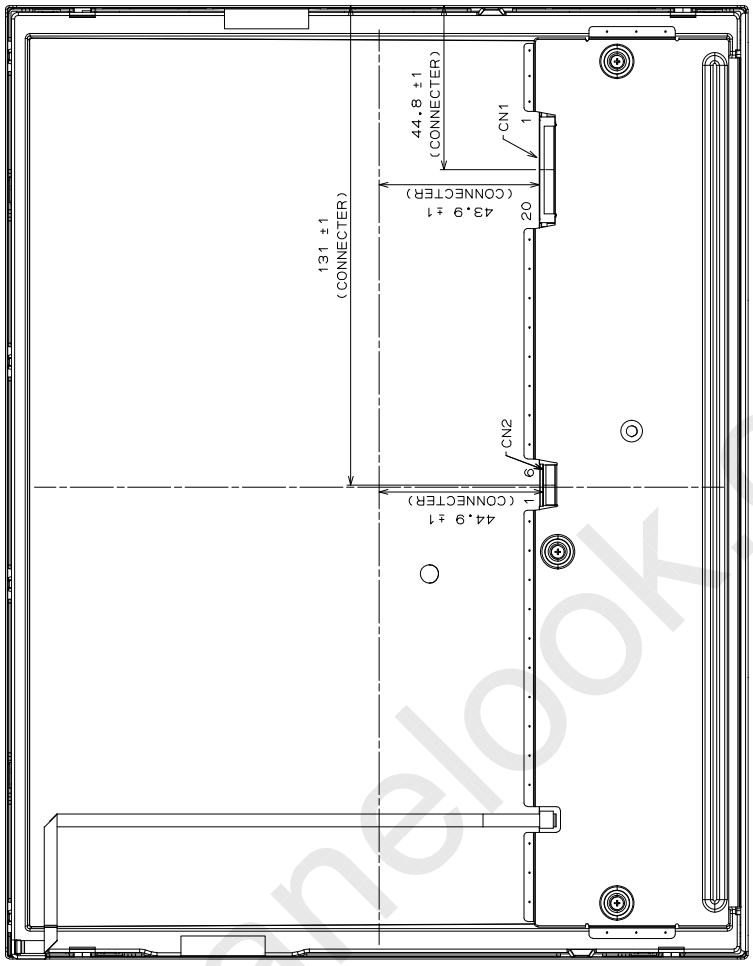
8. MECHANICAL SPECIFICATIONS

(1) Front Side



(Unit: mm)

(2) Rear Side



(Unit: mm)

9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, VL=12.0V, Input Signals: Typ. values shown in Section 6

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	Remarks
Contrast Ratio		CR	θV=0°, θH=0°	(520)	(800)	--	--	*1)*2)*5)
Luminance		Lw	θV=0°, θH=0°	(360)	(450)	--	cd/m²	*1)*5)
Luminance Uniformity		ΔLw	θV=0°, θH=0°	--	--	(30)	%	*1)*3)*5)
Response Time		tr	θV=0°, θH=0°	--	(4)	--	ms	*1)*4)*5)
		tf	θV=0°, θH=0°	--	(12)	--	ms	*1)*4)*5)
Viewing Angle	Horizontal	θH	CR ≥ 10	(–65~65)	(–80~80)	--	°	*1)*5)
	Vertical	θV		(–45~65)	(–60~80)	--	°	*1)*5)
Image sticking		tis	2 h	--	--	2	s	*6)
Color Coordinates	Red	Rx	θV=0°, θH=0°	TBD	TBD	TBD	--	*1)*5)
		Ry		TBD	TBD	TBD		
	Green	Gx		TBD	TBD	TBD		
		Gy		TBD	TBD	TBD		
	Blue	Bx		TBD	TBD	TBD		
		By		TBD	TBD	TBD		
	White	Wx		(0.273)	(0.313)	(0.353)		
		Wy		(0.289)	(0.329)	(0.369)		

[Note]

TBD

TBD

10. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

TEST ITEM	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40°C, 90%RH, 240 h (No condensation)
HIGH TEMPERATURE OPERATION	(80°C), 240 h
LOW TEMPERATURE OPERATION	–30°C, 240 h
HIGH TEMPERATURE STORAGE	(80°C), 240 h
LOW TEMPERATURE STORAGE	–30°C, 240 h
THERMAL SHOCK (NON-OPERATION)	–30°C (1h) ~ (80°C)(1h), 100 cycles

(2) Shock & Vibration

ITEM	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: 1470 m/s^2 (150G) Waveform: half sinusoidal wave, 2 ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: 9.8 m/s^2 (1.0G) Waveform: sinusoidal Frequency range: 5 to 500 Hz Frequency sweep rate: 0.5 octave /min Duration: one sweep from 5 to 500 Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)

(3) Judgment standard

The judgment of the above tests should be made as follow:

Pass: Normal display image, no damage of the display function. (ex. no line defect)
Partial transformation of the module parts should be ignored.

Fail: No display image, damage of the display function. (ex. line defect)

11. OTHER FEATURE

This LCD module complies with RoHS*) directive.

*) RoHS: Restriction of the use of certain hazardous substances in electrical and electronic equipment

12. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling TFT-LCD products;

(1) ASSEMBLY PRECAUTION

a. Please mount the LCD module by using mounting hole with a screw clamping torque (recommended value: 0.3 Nm). Please do not bend or wrench the LCD module in assembling. Please do not drop, bend or twist the LCD module in handling.

b. Please design display housing in accordance with the following guide lines.

(a) Housing case must be designed carefully so as not to put stresses on LCD and not to wrench module.

(b) Under high temperature environment, performance and life time of LED may heavily shorten. When you design with our LCD product, please consider radiating heat and ventilation for good heat management.

(c) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.

(d) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.

(e) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interfere the LCD module. Approximately 1.0 mm of the clearance in the design is recommended.

(f) To avoid local elevation/decrease of temperature, considering location of heating element, heat release, thermal design should be done.

c. Please do not push or scratch LCD panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)

d. Please wipe off LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.

e. Please wipe off drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.

f. Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

g. Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.

h. Please handle metal frame carefully because edge of metal frame is very sharp.

i. Please connect the metal frame of LCD module to GND in order to minimize the effect of external noise and EMI.

j. Be sure to connect the cables and the connecters correctly.

(2) OPERATING PRECAUTIONS

a. Please be sure to turn off the power supply before connecting and disconnecting signal input cable.

b. Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.

c. The interface signal speed is very high. Please pay attention to transmission line design and other high speed signal precautions to satisfy signal specification.

d. Condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature. Please take care so as not to cause any damage mentioned on (1)-d.

e. Please pay attention not to display the same pattern for very long time. Image sticking might happen on LCD. Although image sticking may disappear as the operation time proceeds, screen saver function is recommended not to cause image sticking.

f. Please obey the same safe instructions as ones being prepared for ordinary electronic products.

(3) PRECAUTIONS WITH ELECTROSTATICS

a. This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.

b. Please remove protection film very slowly from the surface of LCD module to prevent from electrostatics occurrence.

(4) STORAGE PRECAUTIONS

LCD should be stored in the room temperature environment with normal humidity. The LCD inventory should be processed by first-in first-out method.

(5) SAFETY PRECAUTIONS

a. When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

(6) OTHERS

a. A strong incident light into LCD panel may cause deterioration to polarizer film, color filter, and other materials, which will degrade the quality of display characteristics. Please do not expose LCD module under strong Ultraviolet rays for a long time.

b. Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.

c. For the packaging box handling, please see and obey with the packaging specification datasheet.